

WE CLAIM:

1. A bipolar junction transistor (BJT), comprising:
 - a BJT structure, comprising:
 - a semi-insulating substrate,
 - a subcollector formed on said substrate,
 - 5 a collector formed on said subcollector,
 - a first metal contact on said subcollector which provides a collector contact for said BJT,
 - a base formed on said collector,
 - 10 an emitter formed on said base,
 - a second metal contact on said emitter which provides an emitter contact for said BJT;
 - a first support post formed on said substrate which is physically and electrically isolated from said BJT structure; and
- 15 15 a third metal contact which extends from the top of said support post to the edge of said base nearest said support post, thereby bridging the physical and electrical separation between said first support post and said base and providing a base contact for said BJT.
2. The BJT of claim 1, wherein said semi-insulating substrate is a compound semiconductor.
3. The BJT of claim 1, wherein said semi-insulating substrate comprises indium phosphide (InP).
4. The BJT of claim 1, wherein said base contact extends over the edge of said base by about $X \mu\text{m}$, where X is the transfer length associated with the process used to fabricate the BJT.
5. The BJT of claim 1, wherein said support post is formed simultaneously with said BJT structure, said support

post comprising:

5 a first layer on said substrate, said first layer comprising the material which comprises said subcollector;

 a second layer on said first layer, said second layer comprising the material which comprises said collector; and

10 a third layer on said second layer, said third layer comprising the material which comprises said base.

6. The BJT of claim 1, wherein said base contact is approximately comb-shaped having a top portion and periodically-spaced teeth extending perpendicularly from said top portion, said top portion of said comb-shaped base 5 contact contacting said base and said teeth extending from said top portion to said first support post.

7. The BJT of claim 1, further comprising:

 a second support post formed on said substrate which is physically and electrically isolated from said BJT structure and is located on the opposite side of said BJT 5 structure from said first support post; and

 a fourth metal contact which extends from the top of said second support post to the edge of said base nearest said support post, thereby bridging the physical and electrical separation between said second support post 10 and said base and providing a second base contact for said BJT.

8. The BJT of claim 1, wherein said subcollector comprises indium phosphide (InP) or indium gallium arsenide (InGaAs).

9. The BJT of claim 1, wherein said collector comprises indium phosphide (InP), indium gallium arsenide (InGaAs), indium aluminum arsenide (InAlAs), or indium

aluminum arsenide phosphide (InAlAsP).

10. The BJT of claim 1, wherein said base comprises indium gallium arsenide (InGaAs).

11. The BJT of claim 1, wherein said emitter comprises indium phosphide (InP) or indium aluminum arsenide (InAlAs).

12. The BJT of claim 1, wherein said semi-insulating substrate is a compound semiconductor and said BJT structure is arranged to form a heterojunction bipolar transistor (HBT).

13. A heterojunction bipolar transistor (HBT), comprising:

an HBT structure, comprising:

5 a semi-insulating substrate comprising a compound semiconductor,

a subcollector formed on said substrate,

a collector formed on said subcollector,

10 a first metal contact on said subcollector which provides a collector contact for said HBT,

a base formed on said collector,

an emitter formed on said base,

15 a second metal contact on said emitter which provides an emitter contact for said HBT;

19 a first support post formed on said semi-insulating substrate which is physically and electrically isolated from said HBT structure, said first support post comprising:

20 a first layer on said substrate, said first layer comprising the material which comprises said subcollector;

a second layer on said first layer, said

second layer comprising the material which comprises said collector; and

25 a third layer on said second layer, said
third layer comprising the material which comprises said
base; and

30 a third metal contact which extends from the top
of said support post to the edge of said base nearest said
support post, thereby bridging the physical and electrical
separation between said support post and said base and
providing a base contact for said HBT, said base contact
extending over the edge of said base by about $X \mu\text{m}$, where X
is the transfer length associated with the process used to
fabricate the HBT.

14. The HBT of claim 13, wherein said semi-insulating
substrate comprises indium phosphide (InP).

15. The HBT of claim 13, wherein said base contact is
approximately comb-shaped having a top portion and
periodically-spaced teeth extending perpendicularly from
said top portion, said top portion of said comb-shaped base
5 contact contacting said base and said teeth extending from
said top portion to said first support post.

16. The HBT of claim 13, further comprising:

5 a second support post formed on said substrate
which is physically and electrically isolated from said HBT
structure and is located on the opposite side of said HBT
structure from said first support post; and

10 a fourth metal contact which extends from the top
of said second support post to the edge of said base
nearest said support post, thereby bridging the physical
and electrical separation between said second support post
and said base and providing a second base contact for said
HBT.

17. The HBT of claim 13, wherein said subcollector comprises indium phosphide (InP) or indium gallium arsenide (InGaAs).

18. The HBT of claim 13, wherein said collector comprises indium phosphide (InP), indium gallium arsenide (InGaAs), indium aluminum arsenide (InAlAs), or indium aluminum arsenide phosphide (InAlAsP).

19. The HBT of claim 13, wherein said base comprises indium gallium arsenide (InGaAs).

20. The HBT of claim 13, wherein said emitter comprises indium phosphide (InP) or indium aluminum arsenide (InAlAs).

21. A heterojunction bipolar transistor (HBT), comprising:

an HBT structure, comprising:

a semi-insulating substrate comprising

5 indium phosphide (InP),

a subcollector formed on said substrate,

a collector formed on said subcollector,

a first metal contact on said subcollector which provides a collector contact for said HBT,

10 a base formed on said collector,

an emitter formed on said base,

a second metal contact on said emitter which provides an emitter contact for said HBT;

15 first and second support posts formed on said semi-insulating substrate on opposite sides of said HBT structure, each of said support posts physically and electrically isolated from said HBT structure, each of said support posts comprising:

a first layer on said substrate, said first
20 layer comprising the material which comprises said
subcollector;

a second layer on said first layer, said
second layer comprising the material which comprises said
collector; and

25 a third layer on said second layer, said
third layer comprising the material which comprises said
base;

30 a third metal contact which extends from the top
of said first support post to the edge of said base nearest
said first support post, thereby bridging the physical and
electrical separation between said first support post and
said base and providing a first base contact for said HBT;
and

35 a fourth metal contact which extends from the top
of said second support post to the edge of said base
nearest said second support post, thereby bridging the
physical and electrical separation between said second
support post and said base and providing a second base
contact for said HBT;

40 wherein each of said base contacts is
approximately comb-shaped having a top portion and
periodically-spaced teeth extending perpendicularly from
said top portion, the top portion of said first base
contact contacting a first edge of said base and the top
45 portion of said second base contact contacting an edge of
said base opposite said first edge and said teeth extending
from the top portions of said first and second base
contacts to said first and second support posts,
respectively, with each of said base contacts extending
50 over the edge of said base by about $X \mu\text{m}$, where X is the
transfer length associated with the process used to
fabricate the HBT.

22. A method of forming a bipolar junction transistor (BJT), comprising:

- providing a semi-insulating substrate,
- depositing a layer of material suitable for use
5 as a BJT subcollector on said substrate,
- depositing a layer of material suitable for use
as a BJT collector on said subcollector layer,
- depositing a layer of material suitable for use
as a BJT base on said collector layer,
- 10 depositing a layer of material suitable for use
as a BJT emitter on said base layer,
- patterning and etching said layers to provide a
vertical gap between said layers down to said substrate,
such that the layers on either side of said gap are
15 physically and electrically isolated from each other,
- patterning and etching said layers on one side of
said gap to provide a BJT structure comprising a
subcollector, a collector, a base, and an emitter, the
layers on the other side of said gap forming a first
20 support post, and
- depositing and patterning a metal layer to
provide a metal contact which extends from the top of said
first support post to the edge of said base nearest said
first support post, thereby bridging the physical and
25 electrical separation between said first support post and
said base and providing a base contact for said BJT.

23. The method of claim 22, wherein said metal layer
is patterned such that said base contact extends over the
edge of said base by about $X \mu\text{m}$, where X is the transfer
length associated with the process used to fabricate the
5 BJT.

24. The method of claim 22, further comprising:
patterning and etching said layers to provide a

second vertical gap between said layers down to said substrate on the opposite side of said BJT structure from
5 said first support post, the layers on the opposite side of said second gap from said BJT structure forming a second support post which is physically and electrically isolated from said BJT structure; and

depositing and patterning said metal layer to
10 provide a fourth metal contact which extends from the top of said second support post to the edge of said base nearest said second support post, thereby bridging the physical and electrical separation between said second support post and said base and providing a second base
15 contact for said BJT.

25. The method of claim 22, wherein said semi-insulating substrate is a compound semiconductor.

26. The method of claim 22, wherein said semi-insulating substrate comprises indium phosphide (InP).

27. The method of claim 22, further comprising the depositing, patterning, and etching of a second metal layer to provide a collector contact for said BJT, and depositing, patterning, and etching of a third metal layer
5 to provide an emitter contact for said BJT.

28. A method of forming a bipolar junction transistor (BJT), comprising:

providing a semi-insulating substrate,
depositing a layer of material suitable for use
5 as a BJT subcollector on said substrate,
depositing a layer of material suitable for use as a BJT collector on said subcollector layer,
depositing a layer of material suitable for use as a BJT base on said collector layer,

10 depositing a layer of material suitable for use
as a BJT emitter on said base layer,
 depositing, patterning, and etching a first metal
layer to provide an emitter contact for said BJT,
 patterning and etching said emitter layer to form
15 an emitter below said emitter contact,
 depositing, patterning, and etching a second
metal layer to provide a base contact for said BJT,
 patterning and etching said base and collector
layers to form a base and a collector below said emitter,
20 and to define the upper portion of a support post which is
physically separate from said emitter, base, and collector,
said base contact extending from the top of said support
post to the edge of said base nearest said support post,
thereby bridging the physical separation between said
25 support post and said base,
 depositing, patterning, and etching a third metal
layer to provide a collector contact for said BJT, and
 patterning and etching said subcollector layer to
form a subcollector below said collector, and to define a
30 lower portion of said support post which is physically
separate from said emitter, base, collector, and
subcollector.

29. The method of claim 28, further comprising:
 depositing a layer of material suitable for use
as a BJT emitter cap on said emitter layer immediately
after depositing said emitter layer, and
5 patterning and etching said emitter cap layer
along with said emitter layer to form said emitter.

30. The method of claim 28, wherein said semi-
insulating substrate comprises indium phosphide (InP).